3 PHYSICAL DEVELOPER

3.1 INTRODUCTION

Water soaked or wet papers rarely contain sufficient amounts of amino acids or salts for effective examination with normal porous surface processes. Components in sweat are either completely removed or diffused throughout the surface. Previous attempts to visualize latent prints on wetted porous items involved air drying and magnetic powder. Under optimum conditions when greasy or oily impressions remain on the surface and fiber swell does not create traps for overall painting, magnetic powder will adhere to the residue.

Physical developer is a product of British Home Office research devised specifically for the examination of wet or water soaked porous items. This technique is a method which utilizes silver nitrate in an unstable ferrous/ferric redox solution in combination with a detergent solution. Unlike the conventional silver nitrate procedure which reacts with the chlorides of palmar sweat, physical developer precipitates silver from the solution to any non-water soluble sebaceous material that is present in a latent print residue. Although this technique was developed for water soaked items it can be used on any porous item, whether water soaked or not.

Since physical developer is an immersion process of high sensitivity, the reagent penetrates the porous material to detect any lipids which may be present. This reaction with residue other than palmar sweat increases the usefulness of physical developer as a post-treatment to items processed with ninhydrin and zinc chloride. However, physical developer cannot be used after the conventional silver nitrate procedure. Physical developer is a somewhat complicated procedure when initially attempted, but can be efficiently incorporated as an examination technique by batch processing eligible items.

Physical developer requires special care and exact adherence to procedures. All glassware and utensils must be dedicated to the technique and reagent contamination must be avoided. In spite of these obstacles, the results often obtained from physical developer can be so productive that it must be included when full evidence exploration of porous items is desired.

3.2 PREPARATIONS

3.2.1 Stock Detergent Solution

1. If distilled water is not available deionized water may be used. Never use tap water for any of the working solutions.

2. Pour one liter of distilled water into a large beaker containing a large magnetic stir bar previously rinsed with distilled water.

3. Add 2.7 grams of n-Dodecylamine Acetate and stir with a magnetic stirrer. If some of the detergent sticks to the weigh boat the weigh boat can be immersed in the solution.

4. Add 4 grams of Synperonic N, a surfactant. Place the weigh boat in the solution as the Synperonic N will adhere to the weigh boat.

5. Stir for thirty minutes.

6. Remove the weigh boat(s).

7. Pour the solution into a one liter glass bottle, transferring any material not yet dissolved. This solution must not be used for at least 24 hours. At this time there should be no visible solids. If solids are present, discard and remix.

-One liter of the stock detergent solution is sufficient to make 25 liters of Physical Developer working solution. The Detergent Stock Solution has an indefinite shelf life.

3.2.2 Maleic Acid Pre-wash

1. Pour one liter of distilled water in a 1500 milliliter beaker.
2. Add 25 grams of Maleic Acid and a large magnetic stir bar rinsed with distilled water.
3. Stir with a magnetic stirrer until all solids are dissolved.

3.2.3 Silver Nitrate Solution

1. Pour 50 milliliter of distilled water into a 100 milliliter beaker.
2. Add 10 grams of silver nitrate and stir for one minute.
3. Stir until dissolved.

3.2.4 Buffered Ferrous/Ferric Redox Solution

1. Pour 900 milliliters of distilled water in a 1500 milliliter beaker.
2. Rinse a large magnetic stir bar with distilled water and place in the beaker and stir.
3. Add the following chemicals in the order given, making sure each chemical is dissolved before adding the next chemical:

   30 grams of Ferric Nitrate
   80 grams of Ferrous Ammonium Sulfate
   20 grams of Citric Acid

4. Stir until the Citric Acid is dissolved and then stir an additional five minutes.

3.2.5 Combining the Component Solutions for Physical Developer

1. To the Redox Solution add 40 milliliters of the Stock Detergent Solution and stir.
2. Examine the Silver Nitrate Solution to ensure that all solid material has dissolved. Stir again if needed. Add the entire Silver Nitrate solution to the redox/detergent solution and stir for two minutes.

*Steps one and two must be performed in this order, otherwise the silver will fall out of suspension.

The Physical Developer is now ready for use. This prepares approximately one liter and should be sufficient to process about one hundred checks. The combined working solution is unstable and can not be stored and should therefore be prepared on an as needed basis.

3.2.6 Polymax Fixer Rinses

3.2.6.1 Rinse 1:

1. Four or five drops of Polymax fixer per liter of tap water in a glass or plastic tray.

3.2.6.2 Rinse 2:

1. Is made by preparing a normal photofix solution with tap water in a glass or plastic tray (one part photographic fixer to nine parts tap water).

3.2.7 Bleach Solution

1. The bleach solution is made by diluting household bleach at a ratio of 1:1 with tap water.

3.3 MINIMUM STANDARDS AND CONTROLS

The Positive Control for the Physical Developer Procedure consists of placing a test impression on a porous, non-evidentiary item, to a make test strip. The test strip is then immersed in the working solution. If the test impression is visualized, the working solution can be used to process evidence. This testing procedure must be done for each working solution at the time the solution is made. Documentation of this process must be done in the form of a reagent log for each batch to include a batch number, established by month/day/year (060404). If additional batches are made on the same day, add an alpha character to the batch number (060404a, b, c, etc.). The batch number must be placed on the working container. Documentation of this process must be included in the examiner's notes by indicating a positive reaction by placing a (+) adjacent to the Physical Developer Procedure. This test must be performed for each case.

3.4 PROCEDURE OR ANALYSIS

The procedure for Physical Developer involves three stages; a pre-wash, reagent development, and rinse. Since the working reagent is unstable, a pre-treatment wash is necessary, unless the items to be processed are too fragile, to avoid the introduction of contaminants to the reagent. The rinse stage essentially removes contaminants and stabilizes the reaction.

All equipment associated with the pre-wash and reagent must be dedicated. Trays must be of glass and must be scrupulously clean. Beakers for mixing solutions should be labeled according to the type of solution and should not be used for any other purpose. Plastic or bamboo tongs without serrated edges should be employed for item handling.

Rinse trays can be the plastic photographic type, but must be clean. Physical Developer reacts with even trace amounts of various rubber products so that rubber tipped tongs must not be used. Similarly, certain gloves will leave marks upon the evidence which will attract silver deposits. After the pre-wash any contact of glove to surface must be avoided.

3.4.1 Step 1- Maleic Acid Pre-wash

1. Pour enough maleic acid pre-wash solution in a glass tray to cover the item to be processed.

2. Immerse the item in the solution for five to ten minutes or until bubbles are no longer given off.

3.4.2 Step 2- Physical Developer Solution

1. Pour enough physical developer solution in a glass tray to cover the items to be processed.

2. Drain the items of excess pre-wash.

3. Immerse the items in the working solution and gently rock the tray.

4. Keep the items separated and be careful not to crease or handle the items extensively.

5. The processing time will vary and can be as little as one minute or up to twenty minutes. Therefore the examiner should monitor the development very closely to avoid over processing and obliteration of weaker impressions. Remove the item when optimum contrast is observed.

3.4.3 Step 3 -Rinse

Two types of rinses are available. The items can be rinsed in a tray of tap water with a constant gentle flow of water into the tray or a two step photofix rinse can be employed.

3.4.3.1 Photofix Rinse

1. After sufficient development in the physical developer solution the item is placed in the first photofix rinse, standard photofix solution, for 30 seconds.

2. Transfer the item into the second photofix rinse (standard photofix solution) for three minutes.

3. Wash the items in running tap water for three to five minutes.

3.4.4 Step 4- Drying

1. Allow the items to dry while lying flat. The items can be blotted carefully with blotter paper to speed the drying process if the item is not fragile.

2. Impressions developed with physical developer are relatively stable. All developed impressions should be photographed.

3.4.5 Step 5- Bleach Solution (optional: to be used only when trying to improve the contrast of darker impressions).

Only proceed with this step after all impressions developed previously have been photographically preserved.

1. Place the item in the bleach solution for two to three minutes.

2. Rinse the item in running tap water for two to three minutes.

3. Photograph any improved impressions.

3.5 INTERPRETATION OF RESULTS

Processing of the porous items with physical developer is similar to photographic development. Latents appear as dark gray images which increase in contrast. The depletion of the working solution is unpredictable due to the inherent instability of the reagent. The failure to produce an image may be due to insufficient or no reactive material present in the item or exhaustion of the chemicals necessary to cause the reaction. Positive controls must be used with each run. Weaker impressions may benefit from additional processing with the physical developer solution. The item to be retreated should not be subjected to fixing with photographic fixer and/or bleaching as these treatments will affect the success of the re-treatment.

Articles which appear too fragile for the maleic acid pre-wash, such as charred papers or extremely water soaked items, may be introduced directly into the physical developer working solution. Such evidence should be treated one item at a time and the solution must be checked carefully for the effects of contamination. Usually contamination will precipitate the silver from the working solution in the form of dark reddish brown particles resembling curds. Contaminated solutions must be discarded and the evidence cannot be processed using contaminated solutions.

3.6 REFERENCES

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